



Optimization of the irrigation time and irrigation frequency by using Hydrus-2D and a capacitance FDR sensor.

Leonor Rodriguez-Sinobas, Javier Benitez Buelga, Maria Gil Rodriguez, Raúl Sánchez Calvo, Guillermo Castañón Lion, Luis Juana Sirgado, and Francisco Laguna Viñuelas

Research group: Irrigation Hydraulics Technical University of Madrid, Spain (leonor.rodriguez.sinobas@upm.es, 34913365845)

The evolution of water content on a sandy soil during the sprinkler irrigation campaign, in the summer of 2010, of a field of sugar beet crop located at Valladolid (Spain) is assessed by a capacitive FDR (Frequency Domain Reflectometry) EnviroScan. This field is one of the experimental sites of the Spanish research center for the sugar beet development (AIMCRA).

The objective of the work focus on monitoring the soil water content evolution of consecutive irrigations during the second two weeks of July (from the 12th to the 28th). These measurements will be used to simulate water movement by means of Hydrus-2D. The water probe logged water content readings (m^3/m^3) at 10, 20, 40 and 60 cm depth every 30 minutes. The probe was placed between two rows in one of the typical 12 x 15 m sprinkler irrigation framework. Furthermore, a texture analysis at the soil profile was also conducted.

The irrigation frequency in this farm was set by the own personal farmer's criteria that aiming to minimizing electricity pumping costs, used to irrigate at night and during the weekend i.e. longer irrigation frequency than expected. However, the high evapotranspiration rates and the weekly sugar beet water consumption—up to 50mm/week—clearly determined the need for lower this frequency. Moreover, farmer used to irrigate for six or five hours whilst results from the EnviroScan probe showed the soil profile reaching saturation point after the first three hours. It must be noted that AIMCRA provides to his members with a SMS service regarding weekly sugar beet water requirement; from the use of different meteorological stations and evapotranspiration pans, farmers have an idea of the weekly irrigation needs. Nevertheless, it is the farmer's decision to decide how to irrigate. Thus, in order to minimize water stress and pumping costs, a suitable irrigation time and irrigation frequency was modeled with Hydrus-2D.

Results for the period above mentioned showed values of water content ranging from 35 and 30 (m^3/m^3) for the first 10 and 20cm profile depth (two hours after irrigation) to the minimum 14 and 13 (m^3/m^3) (two hours before irrigation). For the 40 and 60 cm profile depth, water content moves steadily across the dates: The greater the root activity the greater the water content variation. According to the results in the EnviroScan probe and the modeling in Hydrus-2D, shorter frequencies and irrigation times are suggested.